

ERIOCAULON NIGROBRACTEATUM (ERIOCAULACEAE), A NEW SPECIES FROM THE FLORIDA PANHANDLE, WITH A CHARACTERIZATION OF ITS POOR FEN HABITAT

Steve L. Orzell

Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C,
Tallahassee, Florida 32303 U.S.A.

Edwin L. Bridges

Florida Department of Environmental Regulation, 2600 Blair Stone Road,
Tallahassee, Florida 32399 U.S.A.

ABSTRACT

Eriocaulon nigrobracteatum is described as a new species restricted to deep sapric muck soils of weakly oligotrophic poor fens in the Gulf Coastal Lowlands of the eastcentral Florida panhandle, where it is currently known from Bay, Calhoun, and Gulf counties. It is most similar to *Eriocaulon septangulare* With. of the northern United States, and is distinguished by its generally smaller stature and floral parts, and its exposed dark gray involucre bracts on mature heads. A key is provided to distinguish *E. nigrobracteatum* from other species of *Eriocaulon* in eastern North America. The phenology and narrowly endemic distribution of *E. nigrobracteatum* are discussed. Associated vascular plant taxa and an ecological description of its poor fen habitat are provided.

KEY WORDS: *Eriocaulon nigrobracteatum*, Eriocaulaceae, Florida, poor fens, floristics

In March of 1991, while surveying the flora of sapric seepage herb communities in the Florida panhandle, an unusual, diminutive *Eriocaulon* with fully mature inflorescences was collected from several sites in Bay County. Some of these sites were revisited in early April 1991, and specimens were collected and maintained alive through mid-May in order to observe any changes in their unusually small, dark heads and diminutive stature. In March of 1992

after having identified potential habitat for this plant from black and white aerial photographs (1:24,000) of adjacent Gulf and Calhoun counties, we conducted additional field surveys, which resulted in several sites being located in these counties. Detailed examination revealed several distinct characters which were consistent throughout the growth cycle of the plant, and we became convinced it represented an undescribed, endemic species. A search of the following herbaria (FLAS,FSU,USF,TEX) failed to uncover any specimens of *E. nigrobracteatum*, previous to our collections. The objectives of this paper are: 1) to describe the new species of *Eriocaulon*; and 2) to describe its poor fen habitat.

***Eriocaulon nigrobracteatum* Bridges & Orzell, sp. nov.** TYPE: UNITED STATES. Florida: Bay County: Deep muck quaking seepage herbaceous bog (poor fen) in valley of Sandy Creek, ca. 2.6 mi S of FL 22 jct on both sides of Sandy Creek Road, just N of Alvie Holmes Rd. jct., E of Mule Creek, ca. 0.2 air mi NE of Mule Creek and Sandy Creek jct., ca. 8.5 air mi ESE of Callaway; NEQ, SWQ, SWQ, Sec. 23, T4S, R12W; Allanton 7.5' Quad.; 30°07'00" N, 85°25'14" W; Elev. 13 ft.; 9 Apr 1991, *Orzell & Bridges 16302* (HOLOTYPE: TEX; Isotypes: FLAS,GH,MO,NCU,NY,USF). Figures 1-4.

Herba perennis dense caespitosa. Folia rosulata, e basi albedo viridescens, lineari-attenuata 0.5-1.5(-4.0) × 0.3-1.0 mm, irregulariter incomplete septata. Scapi ocrea folia multo superans, 1.5-2.0(-4.9) cm longa, ore aperto obliquo bifido. Scapus maturus filiformis 5-15(-19) cm longus, 0.2-0.3 mm diam., spiraliter tortus, plerumque 4-carinatus. Capitula matura hemisphaerica 3-4 (-5) mm diam, inferne fusco-nigricantia superne albedo. Receptaculum laeve. Involucre bracteate exteriores late ovatae vel orbiculares 1.0-1.3 × 0.9-1.2 mm, apice obtusae integrae, fusco-nigricantes. Receptaculi bracteolae ± 1 mm, late ovatae, aut omino fusco-griseae aut basi pallescentes, ad apicem dorso margineque pilis clavatis dense obsitae. Flos masculinus: sepala griseo-translucida, oblonga circa 1.2 mm, curvato-concava, obscure carinata, apice rotundata, extus ad apicem et margine superiori pilis clavatis obsita. Petala inter se subaequilongae, pallida, cylindrum angustum ± 1.1 mm longum acutum efformantia, intus circa glandulas et ad margines pilis clavatis albis provisa. Antherae nigrae, late ellipsoideae ± 0.2 mm longae, vix vel haud exsertae, filamentis albis brevibus. Flos foemineus: sepala oblonga, parum curvato-carinata ± 1 mm longa, griseo-translucida, dorso et margine superiori pilis clavatis ciliata. Petala oblonga ± 1 mm, obtusa, intus et secus margines ultra

medium pilis clavatis obsita, superficie interna etiam trichomatibus elongatis multicellularibus translucidis pilosa; capsula pallida brunnea bicarpellata $\pm 0.3 \times 0.6-0.7$ mm; semina orbicularia ± 0.3 mm diam, obscurissime reticulata.

Perennial, forming large dense clumps by basal offshoots. Leaves in a basal rosette, whitish below, dark green above, linear-attenuate, 0.5-1.5(-4.0) cm long, 0.3-1.0 mm wide, irregularly and incompletely septate, tapering evenly from a pale, aerenchymatous base. Sheath of scape much longer than the leaves, 1.5-2.0(-4.9) cm long, the orifice loose, oblique, hyaline, bifid. Mature scape delicately filiform, light green, 5-15(-19) cm long, 0.2-0.3 mm broad, strongly twisted, mostly 4 ridged. Mature heads hemispherical, sometimes globose when pressed, 3.0-4.0(-5.0) mm broad, dark gray to black below due to the exposed involucre bracts, white above due to the densely white-hairy tips of the perianth parts and bractlets. Surface of the receptacle smooth. Outer involucre bracts broadly ovate to orbicular, 1.0-1.3 mm long, 0.9-1.2 mm wide, smooth, dark gray to black, the tips rounded, entire. Receptacular bractlets about 1.0 mm long, broadly ovate, uniformly dark gray or slightly lighter yellowish or whitish at base, the apex densely white clavate hairy on the back and margin. Male flower: sepals gray-translucent, oblong, ca. 1.2 mm long, concave-curved, obscurely keeled, the apex rounded, the outer apex and upper margin densely white clavate hairy. Petals subequal, pale, largely found in a narrowly cylindrical structure about 1.1 mm long, acute, the inner surface around the glands and the margins of the petal lobes with white clavate hairs. Anthers black, broadly ellipsoid, ca. 0.2 mm long, very slightly exerted or not exerted from the head on short white filaments. Female flower: sepals oblong, slightly curved-keeled, ca. 1.0 mm long, gray-translucent, white clavate on the back and upper margin. Petals oblong, ca. 1.0 mm long, obtuse, the upper inner surfaces and upper margins white clavate hairy, the inner surface also densely hairy with long, clear, multicellular trichomes, capsule light brown, bicarpellate, 0.6-0.7 mm wide, ca. 0.3 mm high, seeds orbicular, ca. 0.3 mm long, very obscurely reticulate.

Flowering in March and April, with mature seeds in April and May; scapes and inflorescences scarcely or not at all visible in other seasons.

Additional collections (Paratypes): UNITED STATES. Florida: Bay Co.: same as type locality, 13 Mar 1991, *Orzell & Bridges 16109* (FTG,GA,GH,NCU,NY,S,TEX); Deep muck quaking seepage herbaceous bog (poor fen), near transmission line r-o-w, on slope just NW of r-o-w crossing on Little Sandy Creek, ca. 0.8 air mi upstream from mouth at Sandy Creek, ca. 6.7 air mi NE of Farmdale; SEQ, NWQ, NWQ, Sec. 36, T4S, R12W, Allanton 7.5' Quad.; 30°05'47" N, 85°24'12" W; Elev. 13-20 ft.; 9 Apr 1991, *Orzell & Bridges 16306* (FLAS,MO,NCU,NY,TEX,USF), 13 Mar 1991, *Orzell & Bridges 16103* (FTG,GA,GH,TEX,US); Streamhead seepage bog (poor fen) on N side of FL

20, 0.4 mi W of int. with US 231, ca. 3 mi SSW of Fountain and 5 mi N of Youngstown; SEQ, SWQ, SWQ, Sec. 34, T1N, R12W; Fountain 7.5' Quad.; 30°26'12" N, 85°26'03" W; Elev. 140-150 ft.; 13 Mar 1991, *Orzell & Bridges 16104* (TEX); Seepage bog (poor fen), W of Bay - Gulf Co. line Rd., on N side of Little Sandy Creek, ca. 6.5 air mi NE of Allanton; NEQ, NEQ, SEQ, Sec. 36, T4S, R12W; Allanton 7.5' Quad.; 30°05'30" N, 85°23'27" W; Elev. 13-19 ft.; 13 Mar 1991, *Orzell & Bridges 16105* (FLAS,NCU,TEX,US,USF); Sapric lower slope seepage bog (poor fen), in valley E of sand road, ca. 1.2 air mi W of US 231 at Fountain, in headwaters of Bear Creek, ca. 2 air mi N of FL 20; EH, NWQ, NEQ, Sec. 28, T1N, R12W; Fountain 7.5' Quad.; 30°27'48" N, 85°26'35" W; Elev. 150-160 ft.; 30 Mar 1992, *Orzell, Bridges, & Hilsenbeck 19283* (FSU,SMU,TEX); Quaking, mucky seepage bog (poor fen) above tidally influenced creekside marsh, on W side of timber rd., just N of bridge over Little Sandy Creek, ca. 1.1 mi W of Gulf Co. line and 0.6 mi upstream from Sandy Creek, ca. 6.5 air mi NE of Farmdale; SEQ, NEQ, NEQ, Sec. 35, T4S, R12W; Allanton 7.5' Quad.; 30°05'42" N, 85°24'22" W; Elev. 7-10 ft.; 30 Mar 1992, *Orzell, Bridges, & Hilsenbeck 19289* (Tall Timbers,TEX). **Calhoun Co.:** Lower slope deep muck seepage bog (poor fen), on N side of East Prong just ENE of jct with Bear Creek near Bay - Calhoun Co. line, ca. 12.2 air mi WSW of Clarksville; NWQ, NWQ, Sec. 7 and SWQ, Sec. 6, T1S, R11W; Fountain 7.5' Quad.; 30°25'10" N, 85°23'01" W; Elev. 98-111 ft.; 20 Mar 1992, *Orzell & Bridges 19252* (FLAS,FTG,GA,GH,MICH,MO,NCU,NY,TEX,USF); Mid-slope deep muck seepage bog (poor fen), along unnamed tributary draining NE into Juniper Creek, ca. 6.2 air mi NW of FL 20 bridge over Juniper Creek, ca. 13.7 air mi W of Clarksville; NWQ, SWQ, NEQ and NEQ, SEQ, NWQ, Sec. 30, T1N, R11W; Juniper Creek 7.5' Quad.; 30°27'33" N, 85°29'52" W; Elev. 144-157 ft.; 20 Mar 1992, *Orzell & Bridges 19259* (NCU,TEX,USF). **Gulf Co.:** Lower slope seepage herb bog (poor fen), on E side of Wetappo Creek, ca. 5 air mi S of FL 22 bridge over Wetappo Creek, ca. 6 air mi SW of Wewahitchka; WH, SEQ, Sec. 36, T4S, R11W; Wetappo Creek 7.5' Quad.; 30°05'19" N, 85°17'47" W; Elev. 20-26 ft.; 21 Mar 1992, *Orzell & Bridges 19271* (FLAS,FTG,GA,GH,MICH,MO,NCU,NY,TEX,US,USF); Lower slope mucky seepage bog (poor fen), on N side of Little Sandy Creek (Alligator Creek), ca. 0.4 air mi E of Creek crossing of Bay-Gulf Co. line, ca. 13 air mi W of Wewahitchka; NEQ, SWQ, Sec. 31, T4S, R11W; Allanton 7.5' Quad.; 30°05'23" N, 85°23'03" W; Elev. 13-19 ft.; 21 Mar 1992, *Orzell & Bridges 19278* (NCU,TEX,USF); Lower slope, deep muck, quaking seepage bog (poor fen), on W side of Little Sandy Creek (Alligator Creek), ca. 0.6 air mi NE of creek crossing at Bay-Gulf Co. line, ca. 13 air mi W of Wewahitchka; NWQ, SWQ, NEQ and NEQ, SEQ, NWQ, Sec. 31, T4S, R11W; Allanton 7.5' Quad.; 30°05'43" N, 85°22'54" W; Elev. 19-26 ft.; 21 Mar 1992, *Orzell & Bridges 19276* (FLAS,MO,TEX,USF).

TAXONOMIC RELATIONSHIPS

Eriocaulon nigrobracteatum, among North American species of *Eriocaulon*, is closest in appearance to *E. septangulare* With. (= *E. articulatum* Morong, *E. aquaticum* [Hill] Druce, *E. pellucidum* Michx.), a bog and lakeshore species primarily found from the Canadian Shield south to the Great Lakes region, New England, and southward near the Atlantic coast to eastern North Carolina (Moldenke 1937; Kral 1966, 1989). Disjunct locations of *E. septangulare* are found in Great Britain, the Ridge and Valley Province of Augusta County, Virginia, and questionably in the Blue Ridge Province of Henderson County, North Carolina. *Eriocaulon nigrobracteatum* is distinguished from smaller specimens of *E. septangulare* by its involucre bracts which are not reflexed and are consistently and conspicuously uniformly dark gray even on mature heads, its consistently smaller flower parts, averaging only 2/3 the size of the corresponding parts of *E. septangulare*, and its smaller, orbicular rather than ovate, seed which is reticulate rather than striate. Additionally, the maximum size of the leaves, scapes, and heads of *E. septangulare* are not approached by *E. nigrobracteatum*, although smaller or immature specimens of *E. septangulare* may be a similar size. The glabrous receptacle clearly distinguishes this species from *E. decangulare* L., *E. compressum* Lam., and *E. tezense* Körn., and the dark gray conspicuous involucre bracts and small stature distinguish it from *E. lineare* Small. *Eriocaulon nigrobracteatum* would key imperfectly in Kral (1966) and Godfrey & Wooten (1979) to either *E. ravenelii* Chapm. or *E. kornickianum* van Huerck & Muell.-Arg., both quite different species which do not form the dense, long lived clumps of *E. nigrobracteatum*. Additionally, *E. ravenelii* lacks white clavate hairs on the floral parts and *E. kornickianum* has stramineous outer involucre bracts. *Eriocaulon nigrobracteatum* seems to be consistently the most diminutive *Eriocaulon* in eastern North America north of México. The size of the leaves, scape, and head are reminiscent of *Lachnocaulon digynum* Körn., but it is easily distinguished from this bicarpellate *Lachnocaulon* by its fleshy, unbranched, septate roots, septate leaves with lacunar tissue, dark gray involucre bracts, glabrous receptacle, white clavate trichomes on the floral parts, and black anthers.

The following key (adapted from Kral (1966) and Kral in Godfrey & Wooten (1979)) can be used to distinguish *Eriocaulon nigrobracteatum* from other species of *Eriocaulon* in eastern North America:

1. Heads large, seldom less than 1 cm broad in flower or fruit, scapes seldom shorter than 2 dm tall, leaves seldom shorter than 5 cm long. 2
1. Heads smaller, rarely more than 0.7 mm broad in flower or fruit, scapes rarely as long as 2 dm (except when plants are deeply submersed), leaves usually less than 5 cm long (except when submersed). 3

2. Heads hard when mature, leaves usually exceeding sheath of scape; involucre bracts stramineous, acute. *E. decangulare* L.
2. Heads soft and easily compressed even when mature, leaves shorter than sheath of scape; involucre bracts grayish, rounded.
 *E. compressum* Lam.
3. Surface of the receptacle and/or bases of the florets with many long, narrow, multicellular, translucent trichomes; perianth parts and receptacular bractlets with white clavate trichomes. *E. texense* Körn.
3. Surface of the receptacle glabrous or but sparsely trichomiferous; perianth parts and receptacular bractlets either smooth or with white clavate trichomes. 4
 4. Stamens 6, carpels 3 on an elongate gynophore (rare adventive in Louisiana rice fields). *E. cinereum* R. Br.
 4. Stamens 4, carpels 2 on a short gynophore (widespread in eastern United States). 5
5. Perianth parts and receptacular bractlets with copious white clavate trichomes, thus the upper parts of the heads conspicuously whitened; plants typically forming large clumps by short lateral offshoots or short rhizomes. 6
5. Perianth parts and receptacular bractlets with few or no white clavate trichomes, thus the upper parts of the heads gray or gray and white banded; plants generally solitary or in small, short lived clumps. . . . 8
 6. Outer involucre bracts and most receptacular bracts and sepals whitened or stramineous, thus the lower parts of the heads pale even when young; plants of sandy or peaty lake or pond margins in south Georgia, Florida, and south Alabama *E. lineare* Small
 6. Almost all involucre bracts and all receptacular bracts and sepals darkened, gray to black, thus the lower parts of the heads dark when young; plants widespread in eastern Canada and northern United States, or restricted to seepage bogs (poor fens) in the southern United States. 7
7. Leaves 1-8 cm long; mature scapes 4-21 cm long (or longer when submersed), linear, ca. 1 mm broad; mature heads 4-5 mm broad; involucre bracts gray, reflexed and hidden by the florets on mature heads; sepals ca. 1.5 mm long, petals ca. 1.2-1.5 mm long; seed ovoid, ca. 0.5 mm long. *E. septangulare* With.

7. Leaves 0.5-1.5(-4.0) cm long; mature scapes 5-15(-19) cm long, delicately filiform, 0.2-0.3 mm broad; mature heads mostly 3-4 mm broad (rarely to 5 mm when pressed); all involucre bracts dark gray to black, not reflexed or hidden even on mature heads; sepals 1.0-1.2 mm long, petals 1.0-1.1 mm long; seed orbicular, ca. 0.3 mm long.
 *E. nigrobacteatum* Bridges & Orzell
8. Receptacular bractlets stramineous or gray, often erose or lacerate, broadly acute to obtuse; scapes linear; plants of estuarine areas of the central and northern Atlantic coast. *E. parkeri* B.L. Robinson
8. Receptacular bractlets very dark and lustrous, subentire and narrowly acute; scapes filiform; plants of the southeastern and south-central United States. 9
9. All perianth parts dark, smooth or rarely with a few white clavate trichomes on the inner surface of the female petals; involucre bracts all gray; seed rectangular reticulate, the lines farinose; plants of the outer coastal plain of Florida (and one collection in South Carolina).
 *E. ravenelii* Chapm.
9. Perianth parts with some white clavate trichomes on the margins, thus the heads gray and white banded; outer involucre bracts stramineous; seed papillate or rugose; plants of rock outcrops and seepage areas in Georgia, Arkansas, Oklahoma, and Texas.
 *E. kornickianum* van Huerck & Muell.-Arg.

DISTRIBUTION AND ECOLOGY

Eriocaulon nigrobacteatum is a narrow endemic currently known from eleven sites in eastern Bay (6), and adjacent western Calhoun (2) and northwestern Gulf (3) counties, an area encompassing approximately 689 km² (265 sq mi) in the eastcentral Florida panhandle. The currently known sites are within an area bounded on the east by the lower Chipola River and lower Apalachicola River valleys, extending westward to Bear Creek and its tributaries which discharge to Econfina Creek in northcentral Bay County. All eleven sites are within the Gulf Coastal Lowlands physiographic region (see Brooks 1981; Puri & Vernon 1964), with seven occurring along major south flowing drainages and their tributaries (Sandy and Wetappo Creeks). Four sites occur on the southern portion of the Fountain Slope, the northernmost extension of the Gulf Coastal Lowlands.

Nearly all of the sites for *Eriocaulon nigrobacteatum* occur in mires on deep unstable sapric mucks of lower slope seepage fed herbaceous communities,

which are referred to in this paper as poor fens. Poor fens are oligotrophic to weakly minerotrophic, weakly ionic, somewhat acidic, nutrient deficient, mires which are poor in species of *Sphagnum*, (see Sjörs 1950, 1963). Although the term "poor fen" is prevalent in European wetland literature (Sjörs 1950), and in glaciated North American studies (Cooper 1990, 1991; Crum 1988; Glaser 1983, 1987; Sjörs 1959, 1963; Vitt *et al.* 1975; Wheeler *et al.* 1983; Windell *et al.* 1986), it has not been adopted in references to the vegetation of the southeastern United States coastal plain (except see Bridges & Orzell 1989, page 22). Poor fens of the Florida panhandle are known to the authors to occur along the middle and upper reaches of small stream valleys and their tributaries in the eastern part of the St. Andrews Bay drainage, within the western portion of the Apalachicola Embayment (see Schmidt 1984).

The occurrence of poor fens within the Gulf Coastal Lowlands of the Florida panhandle seems to be correlated with the escarpments of a series of Plio-Pleistocene sandy upland terraces. These coastal terraces reflect various relict shorelines (MacNeil 1950; Rupert 1991; Schmidt & Clark 1980) which, when dissected by perennial stream valleys, provide sufficient topographic relief to intercept groundwater stored in the unconsolidated surficial aquifer, forming poor fens. Although there are differences in the definitions and elevations of these terraces, due to their discontinuous nature and because past episodes of sea level fluctuations do not necessarily leave their remnants at a single elevation, there is a relationship between the ranges of elevations of these poor fens and those of commonly accepted relictual shoreline escarpments. Seven of the fens occur from 7-26 feet above sea level and seem to fall along the dissected escarpment of the Talbot terrace at the top of the Pamlico or Silver Bluff Terrace, at or near the Pamlico shoreline. One fen at 98-111 ft. is at the base of the Okefenokee (Sunderland) Terrace above the Wicomico terrace. The remaining three fens are from 140-160 ft. elevation and at the dissected margin of the Coharie (High Plio-Pleistocene) Terrace above the Okefenokee Terrace.

The surface soil of most of the poor fens is a black decomposed muck (pH 5.4-5.6), sometimes mixed with coarse sand. The depth of the muck layer varies from 30 cm (12 in) to at least 2.2 m (7 ft) and is autochthonous, having originated with the growth of the sedges, with little wood or *Sphagnum* moss present in the muck. One site on Wetappo Creek was underlain by a gray sandy clay layer at a depth of 30 to 45 cm. All other sites were underlain by coarse sand below the muck. The muck substrate is very fluid and contains large, water filled, vacuous channels, making determination of stratification extremely difficult. Soil surveys of these counties have not been conducted in sufficient detail to distinguish a specific poor fen soil type. The soils of these sites would probably be classified in the existing surveys as Rutlege (Typic Humaquepts), Pamlico (Terric Medisaprists), or Dorovan (Typic Medisaprists), with increasing depth of the organic surface. The Wetappo Creek site with the

clay substratum would probably be classified as a Pantego (Umbric Paleaquults), Rains (Typic Paleaquults), or Pelham (Arenic Paleaquults) soil.

Eriocaulon nigrobacteatum can be locally abundant in these poor fens, forming small clumps in habitats permanently saturated by telluric, weakly oligotrophic groundwater seepage on the sapric muck of unstable vegetation mats and in seep spring rivulets within the poor fens. The substrate surface is often covered with mats of an algal periphyton where there is shallow surface water due to a perched water table or associated with seep spring rivulets. Despite some minor floristic differences, the sites can be characterized as low stature herbaceous communities dependent upon the interaction of edaphic and hydrologic factors, and periodic low intensity ground fires, to prohibit succession toward a community dominated by woody species.

We have recorded a total of 172 vascular plants from these poor fens (see Appendix I). Of these, 67 were recorded as close associates of *Eriocaulon nigrobacteatum*; 20 of these 67 were recorded from four or more of the eleven known sites. Seven species of these poor fens are narrowly endemic to the Apalachicola Lowlands region in the Florida panhandle (*Gentiana pennelliana* Fernald, *Pinguicula ionantha* Godfrey, *Nyssa ursina* Small, *Ozypolis greenmanii* Mathias & Constance, *Physostegia godfreyi* Cantino, *Rudbeckia graminifolia* [Torr. & Gray] C.L. Boynt. & Beadle, *Verbesina chapmanii* J.R. Coleman), and nine additional species are endemic to the central East Gulf Coastal Plain (*Arnoglossum sulcatum* [Fern.] H. Robins., *Aster chapmanii* Torr. & Gray, *A. eryngifolius* Torr. & Gray, *Hypericum chapmanii* P. Adams, *Myrica inodora* Bartr., *Panicum nudicaule* Vasey, *Pinguicula planifolia* Chapm., *Sarracenia leucophylla* Raf., *Xyris isoetifolia* Kral). Many other taxa of these communities have ranges centered in Florida, southern Georgia, and/or the outer East Gulf Coastal Plain of southern Alabama, southern Mississippi, and extreme southeastern Louisiana (see Appendix I). Ten species, 6% of the flora recorded at the sites, are currently under federal review for possible listing as federally protected plants and *Pinguicula ionantha* is currently proposed [Federal Register 57(168):39173-39174] for listing as federally threatened (see Appendix I). At one of the Bay County sites there are seven species of Eriocaulaceae (*Eriocaulon compressum*, *E. decangulare*, *E. nigrobacteatum*, *Lachnocaulon anceps* [Walt.] Morong, *L. digynum* Körn., *L. minus* [Chapm.] Small, and *Syngonanthus flavidulus* [Michx.] Ruhl.). These species along with *Eriocaulon tezense*, *Eriocaulon lineare*, and *Lachnocaulon engleri* Ruhl., which we have collected elsewhere in Bay County, and *Lachnocaulon beyrichianum* Sporleder (*Godfrey 64,203* [FSU]) represent the largest number of Eriocaulaceae recorded for any county in the United States.

Few other plants inhabiting the poor fens are at peak anthesis when *Eriocaulon nigrobacteatum* flowers: these include *Aronia arbutifolia* (L.) Pers., *Chaptalia tomentosa* Vent., *Cliftonia monophylla* (Lam.) Britt. ex Sarg., *Gaylussacia mosieri* Small, *Helenium vernale* Walt., *Pinguicula ionantha*, *P. plan-*

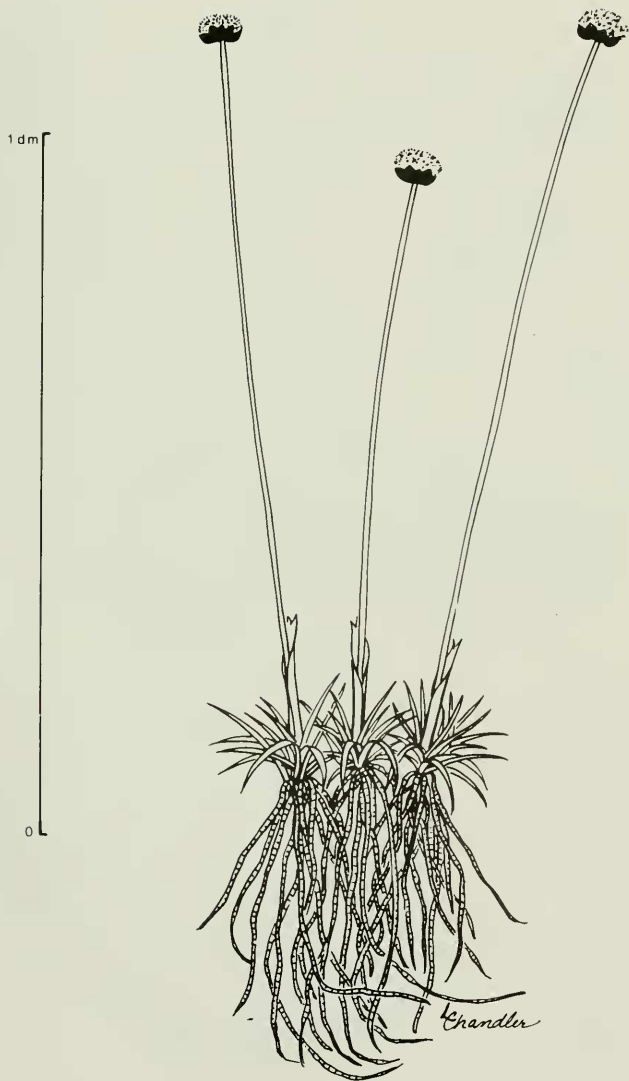


Figure 1: *Eriocaulon nigrobracteatum* Bridges & Orzell. Habit of plant.

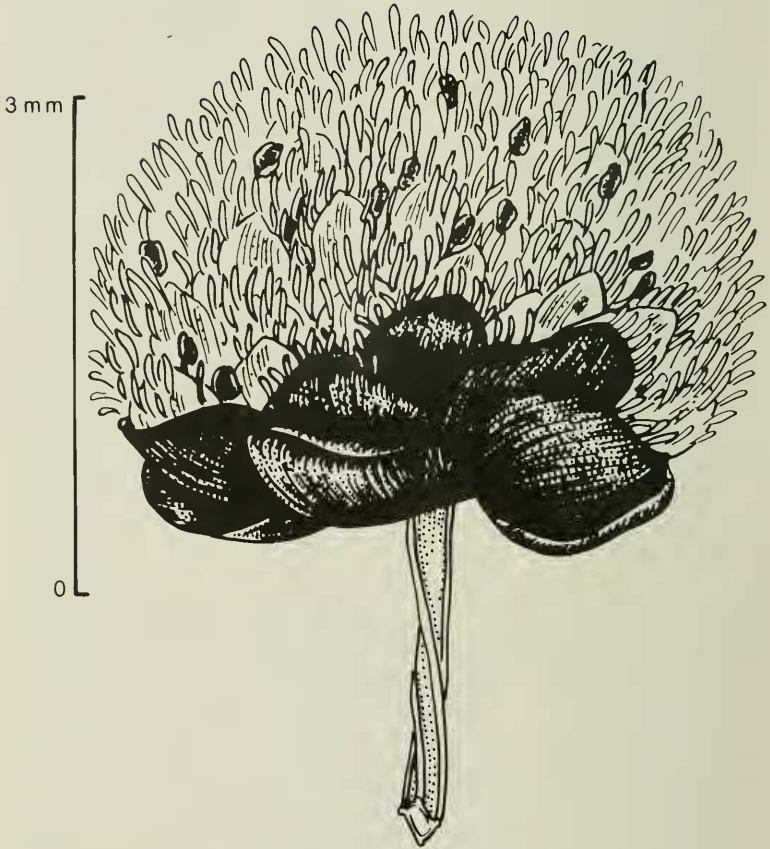


Figure 2: *Eriocaulon nigrobacteatum* Bridges & Orzell. Inflorescence.

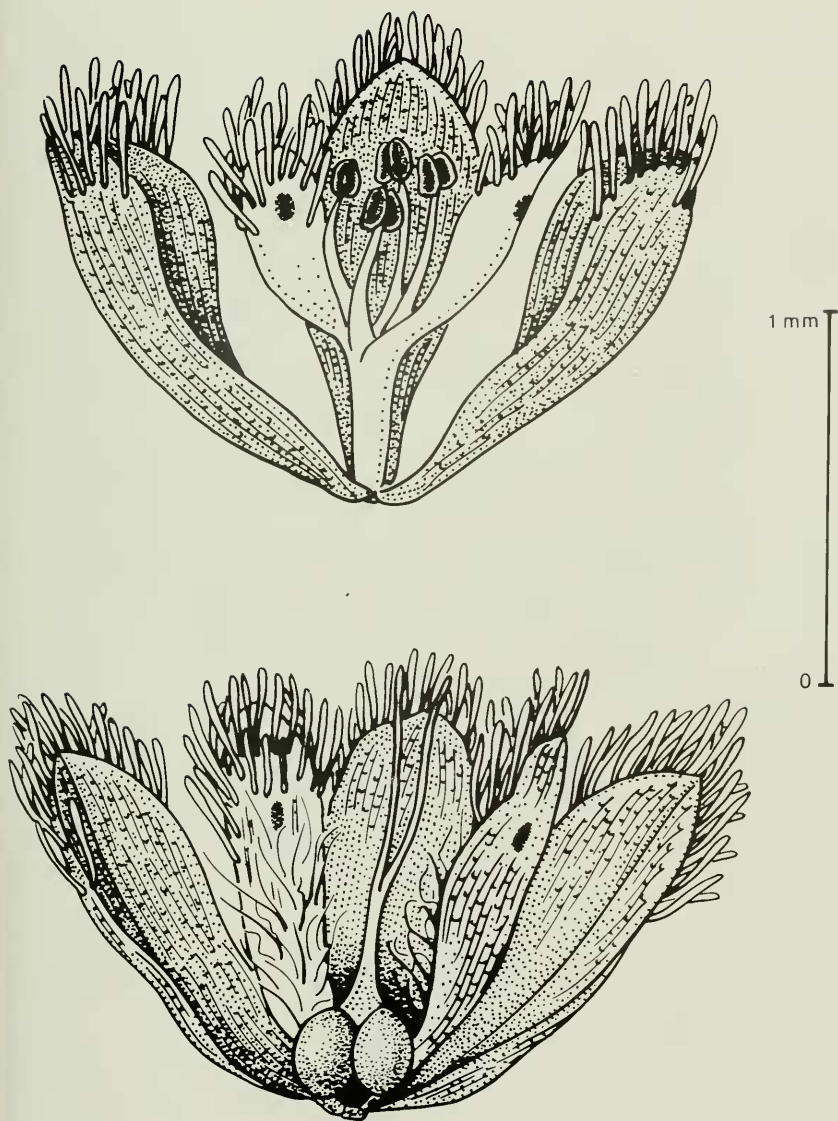


Figure 3: *Eriocaulon nigrobacteatum* Bridges & Orzell. Staminate flower (above); pistillate flower (below).

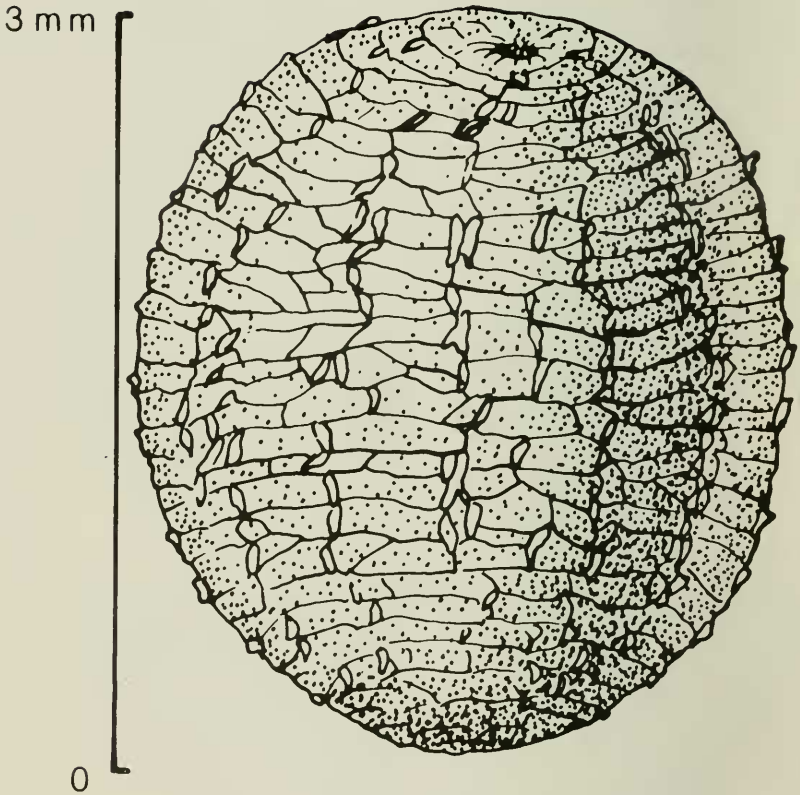


Figure 4: *Eriocaulon nigrobacteatum* Bridges & Orzell. Seed.

ifolia, and *Utricularia subulata* L. Other seepage plants such as *Eriocaulon compressum*, *Sarracenia flava* L., and *Syngonanthus flavidulus* are usually not in full anthesis, but rather in early flower or flower bud, when *E. nigrobracteatum* is in anthesis.

A total of twenty 0.5 m² plots were sampled in March 1992 within *Eriocaulon nigrobracteatum* populations. Ten plots were sampled at each of two sites. Percent vegetative cover by species was determined by species for each of plot, and the data were used to calculate frequency, total cover, and relative cover by species for each site and for both sites combined. The results (quantitative data are not presented, but are available upon request) show that the low statured herbaceous matrix of the sample plots is dominated, in almost equal proportions, by *Rhynchospora macra* (C.B. Clarke) Small, *R. stenophylla* Chapm. ex M.A. Curtis, *Panicum nudicaule*, *Pleea tenuifolia* Michx., *Eriocaulon compressum*, and *E. nigrobracteatum*. Additional species with significantly higher cover and/or frequency values than the remaining associates include (in order of importance) *Sarracenia psittacina* Michx., *Eriocaulon decangulare*, *Drosera capillaris* Poir., *D. tracyi* Macfarlane, *Hypericum brachyphyllum* (Spach) Steud., *Balduina uniflora* Nutt., *Pinguicula planifolia*, *Syngonanthus flavidulus*, *Cliftonia monophylla*, *Aristida affinis* (Schultes) Kunth, and *Utricularia subulata*. Other unrecorded species may occur at similar frequencies in the sample plots but were undetected or underestimated due to the early vernal sampling date.

When comparing floristic and ecological data, one finds some interesting distinctions between the poor fens and that of floristically similar savannas and seepage bogs elsewhere in the Florida panhandle. Poor fens should not be confused with the nearly level, poorly drained ombrotrophic *Pleea* phase savannas described by Clewell (1971, 1981) and Wolfe *et al.* (1988) found primarily within the Apalachicola National Forest. *Aristida stricta* Michx., although present at many of the poor fens, does not form a continuous ground cover as it sometimes does in other herbaceous dominated seepage wetlands and savannas elsewhere in the southeastern United States. The poor fens differ in floristic composition from other seepage bogs in the region, particularly due to the high frequency and cover of the characteristic species *Eriocaulon nigrobracteatum*, *Rhynchospora stenophylla*, *R. macra*, *Pleea tenuifolia*, and *Panicum nudicaule*, whose combined ranges overlap only within the known range of *E. nigrobracteatum* in the eastcentral Florida panhandle. When the combined ranges of these characteristic species, except for *E. nigrobracteatum*, are considered, the area of overlap extends from the western Florida panhandle to adjacent southeastern Alabama (Baldwin County). The poor fen habitat of *E. nigrobracteatum* is a geographically restricted, floristically distinct, mire community type. The discovery of *Eriocaulon nigrobracteatum* and its poor fen habitat is indicative of the need for additional ecological and taxonomic studies involving the rich endemic flora of the Apalachicola Lowlands Region.

ACKNOWLEDGMENTS

Dr. Rupert Barneby (New York Botanical Garden) graciously prepared the Latin description. The technical illustration was prepared by Linda Chandler of Tampa, Florida (Figures 1-4). Material of *Eriocaulon septangulare* from the coastal plain of North Carolina for comparison was provided by Alan Weakley. Guy Nesom and Carol Todzia (University of Texas at Austin) and Richard Hilsenbeck (Florida Natural Areas Inventory) provided helpful review comments. Financial support for the field work and illustration was provided by the Florida Natural Areas Inventory.

LITERATURE CITED

- Bridges, E.L. & S.L. Orzell. 1989. Additions and noteworthy vascular plant collections from Texas and Louisiana, with historical, ecological, and geographical notes. *Phytologia* 66:12-69.
- Brooks, H.K. 1981. Physiographic divisions of Florida. Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, Florida.
- Clewell, A.F. 1971. The vegetation of the Apalachicola National Forest, an ecological perspective. Contract report USDA Forest Service, Tallahassee, Florida. 152 pp.
- . 1981. The natural setting and vegetation of the Florida panhandle. USACE, Contract No. DACW 01-77-C-0104, Mobile, Alabama. 773 pp.
- Cooper, D.J. 1990. Ecology of wetlands in Big Meadows, Rocky Mountain National Park, Colorado. U.S. Fish & Wild. Serv., Biol. Rep. 90(15) 45 pp.
- . 1991. The habitats of three boreal fen mosses new to the southern Rocky Mountains of Colorado. *The Bryologist* 94:49-50.
- Crum, H. 1988. A focus on peatlands and peat mosses. University of Michigan Press, Ann Arbor, Michigan.
- Glaser, P.H. 1983. A patterned fen on the north shore of Lake Superior, Minnesota. *Canadian Field-Nat.* 97:194-199.
- . 1987. The ecology of patterned boreal peatlands of northern Minnesota: a community profile. U.S. Fish & Wild. Serv., Biol. Rep. 85(7.14) 98 pp.

- Godfrey, R.K. & J.W. Wooten. 1979. *Aquatic and Wetland Plants of Southeastern United States - Monocotyledons*. Univ. of Georgia Press, Athens, Georgia. 712 pp.
- Kartesz, J.T. & R. Kartesz. 1980. *A Synonymized Checklist of the Vascular Flora of the United States, Canada, and Greenland*. Vol. II. The Biota of North America. Univ. of North Carolina Press, Chapel Hill, North Carolina. 498 pp.
- Kral, R. 1966. Eriocaulaceae of continental North America north of Mexico. *Sida* 2:285-332.
- . 1989. The genera of Eriocaulaceae in the southeastern United States. *J. Arnold Arboretum* 70:131-142.
- MacNeil, F.S. 1950. Pleistocene shore lines in Florida and Georgia. U.S. Geological Survey Professional Paper 221-F.
- Moldenke, H.N. 1937. Eriocaulaceae. *In*: *N. Amer. Fl.* 19:17-50.
- Puri, H.S. & R.O. Vernon. 1964. Summary of the geology of Florida and a guidebook to the classic exposures. *Fla. Geol. Surv. Spec. Publ. No. 5*. 312 pp.
- Rupert, F.R. 1991. Geology of Gulf County, Florida. *Fla. Geol. Surv. Bull.* 63. 51 pp.
- Schmidt, W. & M.W. Clark. 1980. Geology of Bay County, Florida. *Fla. Geol. Surv. Bull.* 57. 76 pp.
- Schmidt, W. 1984. Neogene stratigraphy and geologic history of the Apalachicola Embayment, Florida. *Fla. Geol. Surv. Bull.* 58. 146 pp.
- Sjörs, H. 1950. On the relation between vegetation and electrolytes in north Swedish mire waters. *Oikos* 2:241-258.
- . 1959. Bogs and fens in the Hudson Bay Lowlands. *Arctic* 12:2-19.
- . 1963. Bogs and fens of the Attawapiskat River, northern Ontario. *Natl. Mus. Can. Bull.* 186:45-133.
- Vitt, D.H., P. Achuff, & R.E. Andrus. 1975. The vegetation and chemical properties of patterned fens in the Swan Hills, north central Alberta. *Can. J. Bot.* 53:2776-2795.

- Wheeler, G.A., P.H. Glaser, E. Gorham, C.M. Wetmore, F.D. Bowers, & J.A. Janssens. 1983. Contributions to the flora of the Red Lake Peatland, northern Minnesota, with special attention to *Carex*. Amer. Midl. Naturalist 110:62-96.
- Windell, J.T., B.E. Willard, D.J. Cooper, S.Q. Foster, C.F. Knud-Hansen, L.P. Rink, & G.N. Kiladis. 1986. An ecological characterization of Rocky Mountain montane and subalpine wetlands. U.S. Fish & Wild. Serv. Biol. Rep. 86(11) 298 pp.
- Wolfe, S.H., J.A. Reidenauer, D.B. Means. 1988. An ecological characterization of the Florida panhandle. U.S. Fish & Wild. Serv. Biol. Rep. 88(12) 277 pp.
- Wunderlin, R.P. & B.F. Hansen. 1991. Preliminary checklist of the vascular flora of Florida. Unpublished manuscript. 100 pp.

APPENDIX I

Vascular plants vouchered at *Eriocaulon nigrobacteatum* sites, based upon repeated site visits made during the 1991 and 1992 growing seasons. The list does not represent a comprehensive vascular plant flora of the sites. Nomenclature follows Kartesz & Kartesz (1980), or in some cases Wunderlin & Hansen (1991). Plant taxa currently listed [Federal Register 55(35):6183-6229] under federal review for possible listing as either federally endangered or threatened species are indicated by (+) following the authority, or (PT) which indicates federally proposed for threatened status. Taxa with ranges centered (>95% of the known localities) in Florida, southern Georgia, and/or the outer East Gulf Coastal Plain of southern Alabama, southern Mississippi, and southeastern Louisiana are indicated by an (*). Plant taxa recorded as close associates of *Eriocaulon nigrobacteatum* are indicated by either (A) for those found at four or more sites or by (B) for those recorded from 1-3 sites.

- Agalinis aphylla* (Nutt.) Raf.
Aletris lutea Small *
Andropogon glomeratus (Walt.) B.S.P.
Anthaenantia rufa (Ell.) Schultes
Aristida affinis (Schultes) Kunth (B)
Aristida stricta Michx. (B)
Arnoglossum ovatum (Walt.) H. Robins.
Arnoglossum sulcatum (Fern.) H. Robins. *
Aronia arbutifolia (L.) Pers.

- Arundinaria tecta* (Walt.) Muhl.
Asclepias connivens Baldw. ex Ell. *
Aster chapmanii Torr. & Gray + *
Aster eryngiifolius Torr. & Gray + *
Balduina uniflora Nutt. (A)
Bartonia paniculata (Michx.) Muhl.
Bartonia verna (Michx.) Raf. ex Barton
Bartonia virginica (L.) B.S.P.
Bidens mitis (Michx.) Sherff.
Bigelovia nudata (Michx.) DC. (B)
Burmanna capitata (Walt.) Mart.
Calopogon barbatus (Walt.) Ames
Calopogon tuberosus (L.) B.S.P.
Carex atlantica Bailey subsp. *atlantica*
Carex striata Michx.
Carphephorus pseudoliatris Cass. * (B)
Centella asiatica (L.) Urban
Chaptalia tomentosa Vent. (B)
Cirsium lecontei Torr. & Gray
Clethra alnifolia L.
Cliftonia monophylla (Lam.) Britt. ex Sarg. * (A)
Coreopsis linifolia Nutt. (B)
Coreopsis nudata Nutt. *
Ctenium aromaticum (Walt.) Wood (B)
Cyrilla racemiflora L. (B)
Dichantheium scabriusculum (Ell.) Gould & C.A. Clark (B)
Drosera capillaris Poir. (A)
Drosera intermedia Hayne
Drosera tracyi Macfarlane * (A)
Dulichium arundinaceum (L.) Britt.
Eleocharis tuberculosa (Michx.) Roemer & Schultes (B)
Erigeron vernus (L.) Torr. & Gray
Eriocaulon compressum Lam. (A)
Eriocaulon decangulare L. (A)
Eriocaulon tezense Körn.
Eryngium integrifolium Walt.
Eupatorium leucolepis (DC.) Torr. & Gray
Eupatorium pilosum Walt.
Eupatorium rotundifolium Walt.
Fuirena scirpoidea Michx.
Gaylussacia mosieri Small * (B)
Gentiana pennelliana Fernald *
Gratiola pilosa Michx.

- Helenium vernale* Walt. (A)
Helianthus angustifolius L.
Helianthus heterophyllus Nutt.
Hibiscus aculeatus Walt.
Hypericum brachyphyllum (Spach) Steud. * (A)
Hypericum chapmanii P. Adams ' (B)
Hypericum cistifolium Lam.
Hypericum fasciculatum Lam. (B)
Hypericum nitidum Lam. *
Hypericum stans (Michx.) P. Adams & Robson
Ilex coriacea (Pursh) Chapm.
Ilex glabra (L.) A. Gray (B)
Ilex myrtifolia Walt.
Juncus debilis A. Gray
Juncus marginatus Rostk.
Juncus trigonocarpus Steud. (A)
Lachnanthes caroliniana (Lam.) Dandy
Lachnocaulon anceps (Walt.) Morong
Lachnocaulon digynum Körn. + (A)
Lachnocaulon minus (Chapm.) Small
Liatris spicata (L.) Willd. (B)
Linum medium (Planch.) Britt. (B)
Lobelia floridana Chapm. *
Lobelia glandulosa Walt.
Lobelia puberula Michx. (B)
Lophiola aurea Ker-Gawl. * (B)
Lycopodiella alopecuroides (L.) Cranfill
Lycopodiella appressa (Chapm.) Cranfill
Lycopodiella caroliniana (L.) Pichi Sermolli (B)
Lycopodiella cernua (L.) Pichi Sermolli
Lycopodiella prostrata (Harper) Cranfill (B)
Lyonia lucida (Lam.) K. Koch
Magnolia virginiana L. (B)
Marshallia tenuifolia Raf.
Mitreola angustifolia (Torr. & Gray) J. Nelson
Mitreola sessilifolia (J.F. Gmelin) Torr. & Gray
Muhlenbergia capillaris (Lam.) Trin. var. *trichopodes* (Ell.) Vasey
Myrica cerifera L.
Myrica heterophylla Raf. (B)
Myrica inodora Bartr. *
Nyssa sylvatica Marsh. var. *biflora* (Walt.) Sarg.
Nyssa ursina Small * (B)
Ozypolis filiformis (Walt.) Britt. (B)

- Oryzopsis greenmanii* Mathias & Constance * (B)
Panicum ensifolium Baldw. ex Ell.
Panicum nudicaule Vasey + * (A)
Peltandra sagittifolia (Michx.) Morong *
Persea palustris (Raf.) Sarg.
Physostegia godfreyi Cantino *
Pinckneya bracteata (Bartr.) Raf. *
Pinguicula ionantha Godfrey PT * (B)
Pinguicula lutea Walt.
Pinguicula planifolia Chapm. + * (A)
Pinus elliottii Engelm.
Pinus palustris P. Mill.
Pinus serotina Michx.
Platanthera blephariglottis (Willd.) Lindl.
Platanthera ciliaris (L.) Lindl.
Platanthera integra (Nutt.) A. Gray ex Beck
Platanthera nivea (Nutt.) Luer
Pleea tenuifolia Michx. (A)
Pogonia ophioglossoides (L.) Ker-Gawl. (B)
Polygala chapmanii Torr. & Gray *
Polygala cymosa Walt.
Polygala brevifolia Nutt. *
Polygala cruciata L. (B)
Polygala hookeri Torr. & Gray *
Polygala lutea L. (B)
Polygala ramosa Ell.
Rhezia alifanus Walt.
Rhezia lutea Walt.
Rhezia mariana L.
Rhezia petiolata Walt.
Rhododendron viscosum (L.) Torr.
Rhynchospora baldwinii A. Gray (B)
Rhynchospora cephalantha A. Gray
Rhynchospora chalarocephala Fern. & Gale (B)
Rhynchospora chapmanii M.A. Curtis (B)
Rhynchospora corniculata (Lam.) A. Gray (B)
Rhynchospora filifolia A. Gray
Rhynchospora gracilentia A. Gray (B)
Rhynchospora harperi Small *
Rhynchospora inundata (Oakes) Fern.
Rhynchospora latifolia (Baldw. ex Ell.) W. Thomas
Rhynchospora macra (C.B. Clarke) Small (A)
Rhynchospora oligantha A. Gray (B)

- Rhynchospora plumosa* Ell.
Rhynchospora stenophylla Chapm. ex M.A. Curtis (A)
Rudbeckia graminifolia (Torr. & Gray) C.L. Boynt. & Beadle * (B)
Sabatia bartramii Wilbur *
Sabatia campanulata (L.) Torr.
Sabatia macrophylla Hook. (A) *
Sarracenia flava L. (B)
Sarracenia leucophylla Raf. + * (B)
Sarracenia psittacina Michx. * (A)
Schoenolirion albiflorum (Raf.) R.R. Gates * (B)
Scleria baldwinii (Torr.) Steud. (B)
Scleria reticularis Michx.
Smilax laurifolia L. (B)
Smilax walteri Pursh
Solidago stricta Aiton
Spiranthes praecox (Walt.) S. Wats.
Stillingia aquatica Chapm. *
Syngonanthus flavidulus (Michx.) Ruhl. (A)
Taxodium ascendens Brongn. (B)
Tofieldia racemosa (Walt.) B.S.P. (B)
Utricularia juncea Vahl.
Utricularia subulata L. (A)
Verbesina chapmanii J.R. Coleman + *
Woodwardia areolata (L.) T. Moore
Woodwardia virginica (L.) J.E. Smith
Xyris ambigua Beyr. ex Kunth (B)
Xyris baldwiniana Schultes (A)
Xyris difformis Chapm. var. *curtissii* (Malme) Kral
Xyris drummondii Malme + (A)
Xyris fimbriata Ell.
Xyris isoetifolia Kral + * (B)
Xyris scabrifolia Harper + (B)
Xyris serotina Chapm. * (B)
Xyris stricta Chapm. *